

Advanced Computational Fluid Dynamics (CFD)

Completed Technology Project (2012 - 2018)



Project Introduction

It is time for the next generation of aerothermodynamic CFD software, including unstructured gridding, low dissipation fluxes, dynamic simulations, and modern software engineering techniques.

Anticipated Benefits

NASA funded: Deliver improved DSMC modeling capability for use on ISS station keeping. Deliver predictive capability for parachute descent dynamics with direct benefit to Orion/CPAS. NASA unfunded: Deliver new validated capability to calculate dynamic stability derivatives, with direct benefit to all future entry missions. Develop validated parachute descent modeling capability with direct benefit for all missions with parachutes, with a particular focus on Mars applications. OGA: An active partnership with AFOSR ensures that NASA and DoD invest in complimentary areas. Both agencies have a direct interest in thermochemical nonequilibrium flows. Commercial: All of EDL Modeling and Simulation is of direct benefit to commercial space. Commercial companies generally rely on NASA developed tools for in-house EDL analysis (including aerothermodynamics), and thus directly benefit from improvements to those tools. Nation: EDL Modeling and Simulation is an enabling capability for spaceflight. Our ability to conduct larger and more complex missions is limited first and foremost by cost, which is a strong function of how well we understand the required system performance. By developing higher fidelity, more accurate predictive M&S capability we enable the customer to make better informed decisions and to better understand performance limits of current and future technologies. A natural consequence is increased reliability, lower mass, and a better understanding of when a fundamentally new technology is in fact required to meet mission objectives.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

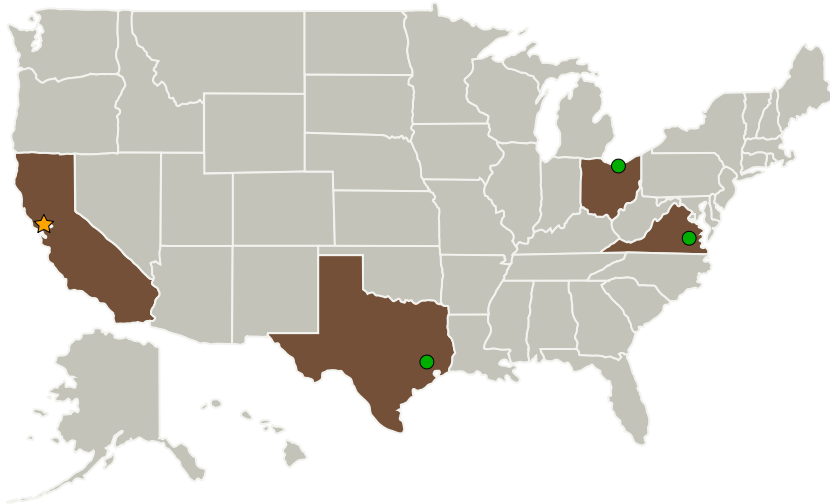
Ames Research Center (ARC)

Responsible Program:

Game Changing Development



Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio
● Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Co-Funding Partners	Type	Location
Space Technology Research Grants(STRG)	NASA Program	

Project Management

Program Director:

Mary J Werkheiser

Program Manager:

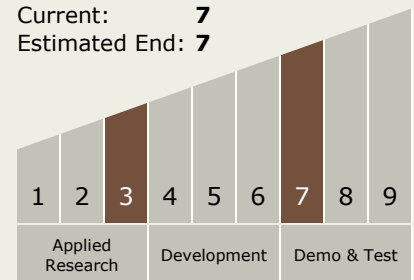
Gary F Meyering

Principal Investigator:

Michael J Wright

Technology Maturity (TRL)

Start: 3
 Current: 7
 Estimated End: 7



Target Destinations

Mars, Earth



Primary U.S. Work Locations

California	Ohio
Texas	Virginia

Project Transitions

**October 2012:** Project Start**September 2018:** Closed out

Closeout Summary: This technology achieved its key performance parameters for a database. However, there are no TRL metrics for this technology. The primary objective of the High Enthalpy Database Task within the Entry Systems Modeling Project was to acquire aerothermal data at conditions relevant to atmospheric entry at Mars. Acquired data were used to determine the suitability of other ground-based gas radiation test facilities at CUBRC and CalTech often used to validate Mars aerothermal model validation. Experimental data and model modifications have been employed to update CFD predictive capabilities used by NASA for design and analysis of future Mars missions. This advancement will permit MEDLI-1 to better understand flight data from the 2012 MSL entry and facilitate the design and analysis of MEDLI-2 instrumentation.

Project Website:

https://www.nasa.gov/directorates/spacetech/game_changing_development/index.html